

Chapter 14 Statistics

1. $Mode + \frac{2}{3}(Mean - Mode) =$ (1)

- a. Mode
- b. Median
- c. Mean
- d. None of these

2. Construction of cumulative frequency table is useful to determine (1)

- a. mean
- b. all the three
- c. median
- d. mode

3. For the following distribution

Class	Below 10	Below 20	Below 30	Below 40	Below 50	Below 60
Frequency	3	12	27	57	75	80

the modal class is (1)

- a. 50 - 60
- b. 40 - 50
- c. 20 - 30
- d. 30 - 40

4. The mean of the first 10 natural numbers is (1)

- a. 4.5
- b. 5
- c. 6
- d. 5.5

5. The marks obtained by 9 students in Mathematics are 59, 46, 30, 23, 27, 44, 52, 40 and 29. The median of the data is **(1)**
- 35
 - 29
 - 30
 - 40
6. Find the mode of the given data 3, 3, 7, 4, 5, 3, 5, 6, 8, 9, 5, 3, 5, 3, 6, 9, 7, 4. **(1)**
7. If the median of a series exceeds the mean by 3, find by what number the mode exceeds its mean? **(1)**
8. If the values of mean and median are 26.4 and 27.2, what will be the value of mode? **(1)**
9. In the following frequency distribution, find the median class. **(1)**

Height (in cm)	140 -145	145-150	150-155	155 -160	160 -165	165 -170
Frequency	5	15	25	30	15	10

10. Find median of the data, using an empirical relation when it is given that Mode = 12.4 and Mean = 10.5. **(1)**
11. Find the mode of the following distribution. **(2)**

Class interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	8	7	12	28	20	10	10

12. Convert the following data into 'more than type' distribution: **(2)**

Class	50 - 55	55 - 60	60 - 65	65 - 70	70 - 75	75 - 80
Frequency	2	8	12	24	38	16

13. Calculate the mean of the following data, using direct method: **(2)**
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Class	25 - 35	35 - 45	45 - 55	55 - 65	65 - 75
Frequency	6	10	8	12	4

14. If the median of the following frequency distribution is 46, find the missing frequencies. (3)

Variable	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
Frequency	12	30	?	65	?	25	18	229

15. Find median for the following data: (3)

Wages(in Rs)	Number of workers
More than 150	Nil
More than 140	12
More than 130	27
More than 120	60
More than 110	105
More than 100	124
More than 90	141
More than 80	150

16. Draw a pie-chart for the following data of expenditure on various items in a family.

Item	Education	Food	Rent	Clothing	Others
Expenditure (in Rs.)	1600	3200	4000	2400	3200

3

17. Find the mean and mode of the following frequency distribution: (3)

Classes	0 - 10	10 -20	20 -30	30 -40	40 -50	50 -60	60 -70
Frequency	3	8	10	15	7	4	3

18. From the following frequency distribution, prepare the 'more than' ogive. (4)

Score	Number of candidates
400 - 450	20
450 - 500	35
500 - 550	40
550 - 600	32
600 - 650	24
650 - 700	27
700 - 750	18
750 - 800	34
Total	230

Also, find the median.

19. Find the mean marks of students from the following cumulative frequency distribution: (4)

Marks	Number of students
0 and above	80
10 and above	77
20 and above	72
30 and above	65
40 and above	55
50 and above	43
60 and above	28
70 and above	16
80 and above	10

90 and above	8
100 and above	0

20. The marks obtained by 100 students of a class in an examination are given below:

Marks	Number of students
0 - 5	2
5 - 10	5
10 - 15	6
15 - 20	8
20 - 25	10
25 - 30	25
30 - 35	20
35 - 40	18
40 - 45	4
45 - 50	2

Draw cumulative frequency curves by using (i) 'less than' series and (ii) 'more than' series.

Hence, find the median. **(4)**

Chapter 14 Statistics

Solution

1. b. Median

Explanation: Since, $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$

$$\Rightarrow \text{Median} = \frac{\text{Mode}}{3} + \frac{2}{3} \text{Mean}$$

$$\Rightarrow \text{Median} = \frac{\text{Mode}}{3} + \frac{2}{3} \text{Mean} - \frac{2}{3} \text{Mode} + \frac{2}{3} \text{Mode}$$

$$\Rightarrow \text{Median} = \text{Mode} + \frac{2}{3} [\text{Mean} - \text{Mode}]$$

2. c. median

Explanation: A cumulative frequency distribution is the sum of the class and all classes below it in a frequency distribution. Construction of cumulative frequency table is useful to determine Median.

3. d. 30 – 40

Explanation: According to the question,

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Freq	3	9	15	30	18	5

Here Maximum frequency is 30.

Therefore, the modal class is 30 – 40.

4. d. 5.5

Explanation: The first 10 natural numbers are 1, 2, 3,, 10

$$\therefore \text{Mean} = \frac{\text{Sum of first 10 natural numbers}}{10}$$

$$= \frac{1+2+3+\dots+10}{10}$$

$$= \frac{55}{10} = 5.5$$

5. d. 40

Explanation: Arranging the given data in ascending order: 23, 27, 29, 30, 40, 44, 46, 52, 59

Here $n = 9$, which is even.

$$\therefore \text{Median} = \left(\frac{n+1}{2} \right)^{\text{th}}$$

$$= \left(\frac{9+1}{2} \right)^{\text{th}} \text{ term}$$

$$= 5\text{th term} = 40$$

6.

Value x	3	4	5	6	7	8	9
Frequency f	5	2	4	2	2	1	2

We observe that the value 3 has the maximum frequency i.e 5 .

The mode of data is 3.

7. Given,

$$\text{Median} = \text{Mean} + 3$$

$$\text{Since, Mode} = 3 \text{ Median} - 2 \text{ Mean}$$

$$= 3 (\text{Mean} + 3) - 2\text{Mean}$$

$$= 3\text{Mean} + 9 - 2\text{mean}$$

$$\Rightarrow \text{Mode} = \text{Mean} + 9$$

Hence Mode exceeds Mean by 9.

8. We know that

$$\text{Mode} = 3 \text{ median} - 2 \text{ mean}$$

$$= 3(27.2) - 2(26.4)$$

$$= 81.6 - 52.8 = 28.8$$

$$\text{Mode} = 28.8$$

9.

Height	Frequency	c.f.
140 – 145	5	5
145 – 150	15	5 + 15 = 20
150 – 155	25	25 + 20 = 45
155 – 160	30	45 + 30 = 75
160 – 165	15	75 + 15 = 90
165 – 170	10	90 + 10 = 100
	$\Sigma f = 100$	

$$N = 100$$

$$\Rightarrow \frac{N}{2} \text{th term} = \frac{100}{2} = 50\text{th term}$$

Hence, Median class is 155 - 160.

10. Mode = 3 median - 2 mean

Mode = 12.4 and mean = 10.5

$$\text{Median} = \frac{1}{3} \text{Mode} + \frac{2}{3} \text{Mean}$$

$$= \frac{1}{3} (12.4) + \frac{2}{3} (10.5)$$

$$= \frac{12.4}{3} + \frac{21}{3}$$

$$= \frac{12.4+21}{3}$$

$$= \frac{33.4}{3}$$

$$= 11.13$$

So, median is 11.13.

11.

Class interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	8	7	12	28	20	10	10

Here the maximum frequency is 28 then the corresponding class 40 - 52 is the modal class

$$l = 40, h = 50 - 40 = 10, f = 28, f_1 = 12, f_2 = 20$$

$$\text{Mode} = l + \frac{f - f_1}{2f - f_1 - f_2} \times h$$

$$= 40 + \frac{28 - 12}{2 \times 28 - 12 - 20} \times 10$$

$$= 40 + \frac{160}{24}$$

$$= 40 + 6.67$$

$$= 46.67$$

12.

Class	Frequency	Cumulative Frequency
More than 50	2	98 + 2 = 100
More than 55	8	90 + 8 = 98
More than 60	12	78 + 12 = 90
More than 65	24	54 + 24 = 78
More than 70	38	16 + 38 = 54

More than 75	16	16
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13.

Class Interval	Frequency	Class mark x_i	$f_i x_i$
25 - 35	6	30	180
35 - 45	10	40	400
45 - 55	8	50	400
55 - 65	12	60	720
65 - 75	4	70	280
	$\Sigma f_i = 40$		$\Sigma (f_i x_i) = 1980$

from table ,

$$\Sigma f_i = 40 , \Sigma (f_i x_i) = 1980$$

we know that,

$$\begin{aligned} \text{mean} &= \frac{\Sigma f_i x_i}{\Sigma f_i} \\ &= \frac{1980}{40} \\ &= 49.5 \end{aligned}$$

14. Let the frequency of the class 30 - 40 be f_1 and that of the class 50 - 60 be f_2 . The total frequency is 229.

$$\Rightarrow 12 + 30 + f_1 + 65 + f_2 + 25 + 18 = 229$$

$$\Rightarrow f_1 + f_2 = 79$$

It is given that the median is 46

Clearly, 46 lies in the class 40 - 50. So, 40 - 50 is the median class.

$$\therefore l = 40, h = 10, f = 65 \text{ and}$$

$$F = 12 + 30 + f_1$$

$$= 42 + f_1,$$

$$N=229$$

$$\text{Median} = l + \frac{\frac{N}{2} - F}{f} \times h$$

$$46 = 40 + \frac{\frac{229}{2} - (42 + f_1)}{65} \times 10$$

$$46 = 40 + \frac{145 - 2f_1}{13}$$

$$6 = \frac{145-2f_1}{13} \Rightarrow 2f_1 = 67 \Rightarrow f_1 = 33.5 \text{ or } 34(\text{ say })$$

Since $f_1 + f_2 = 79$,

$$f_2 = 79 - 34$$

$$=45$$

Hence, $f_1 = 34$ and $f_2 = 45$

15.

C.I.	f	c.f.
80 - 90	9	9
90 - 100	17	26
100 - 110	19	45
110 - 120	45	90
120 - 130	33	123
130 - 140	15	138
140 - 150	12	150

$$n = 150 \Rightarrow \frac{n}{2} = 75$$

Median Class = 110 – 120

$$l = 110, f = 45, c.f. = 45, h = 10$$

we know that, Median = $l + \frac{\frac{n}{2} - cf}{f} \times h$

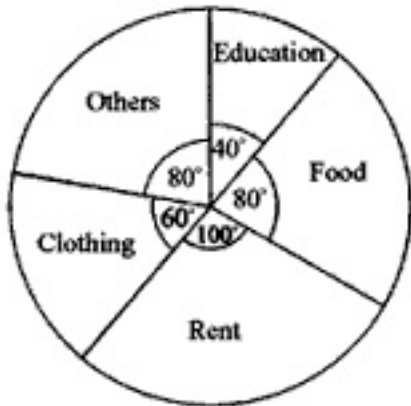
$$= 110 + \frac{75-45}{45} \times 10$$

$$= 116.67$$

16.

Item	Expenditure (E _i)	Central angle = $\left[\frac{E_i}{14400} \times 360 \right]$
Education	1600	$\left[\frac{1600}{14400} \times 360 \right] = 40^\circ$
Food	3200	$\left[\frac{3200}{14400} \times 360 \right] = 80^\circ$
Rent	4000	$\left[\frac{4000}{14400} \times 360 \right] = 100^\circ$
Clothing	2400	$\left[\frac{2400}{14400} \times 360 \right] = 60^\circ$

Others	3200	$\left[\frac{3200}{14400} \times 360 \right] = 80^\circ$
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17.

Class interval	x_i	f_i	$f_i x_i$
0 – 10	5	3	15
10 – 20	15	8	120
20 – 30	25	10	250
30 – 40	35	15	525
40 – 50	45	7	315
50 – 60	55	4	220
60 – 70	65	3	195
		$\Sigma f_i = 50$	$\Sigma f_i x_i = 1640$

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{1640}{50}$$

$$\text{Mean} = 32.8$$

For Mode, Modal class = 30 - 40

and $l = 30$, $f_1 = 15$, $f_2 = 7$, $f_0 = 10$, $h = 10$

$$\begin{aligned} \text{Mode} &= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h \\ &= 30 + \frac{15 - 10}{2(15) - 10 - 7} \times 10 \\ &= 30 + \frac{15 - 10}{30 - 10 - 7} \times 10 \\ &= 30 + \frac{5}{13} \times 10 \\ &= 30 + \frac{50}{13} \end{aligned}$$

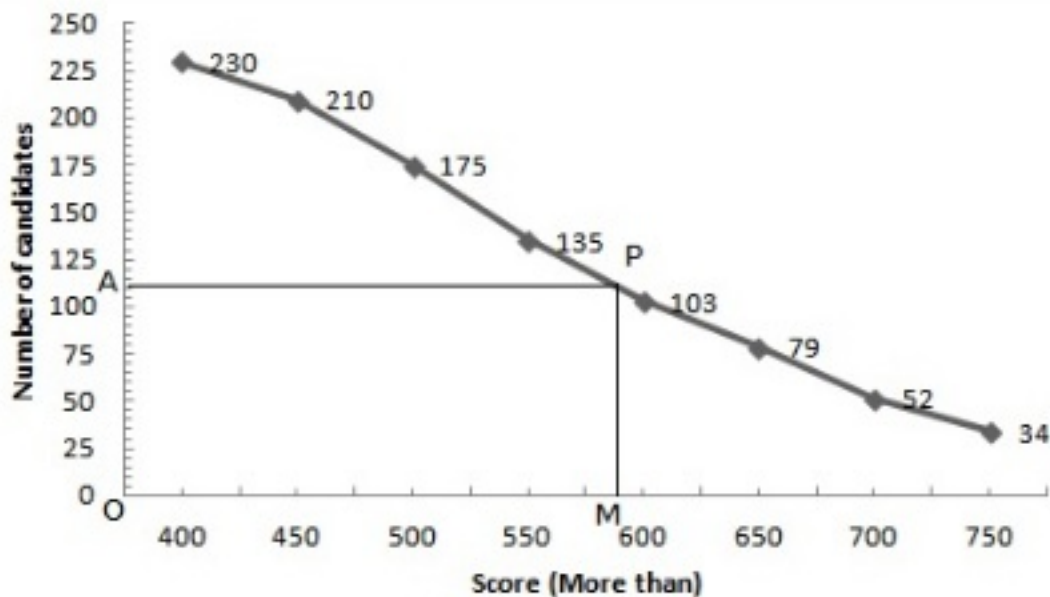
$$\begin{aligned}
 &= 30 + \frac{50}{13} \\
 &= 30 + 3.85 \\
 &= 33.85
 \end{aligned}$$

Mean of given data is 32.8 and mode is 33.85.

18. More than series:

Score	Number of candidates
More than 400	230
More than 450	210
More than 500	175
More than 550	135
More than 600	103
More than 650	79
More than 700	52
More than 750	34

plot the points (400, 230), (450, 210), (500, 175), (550, 135), (600, 103), (650, 79), (700, 52), (750, 34).



$$N = 230 \Rightarrow \frac{N}{2} = 115$$

Take a point A(0, 115) on the y-axis and draw AP || x-axis meeting the curve at P, Draw PM \perp x-axis intersecting x-axis at M

$$OM = 590$$

Hence, median = 590

19. Here we have, the cumulative frequency distribution.

So, first we convert it into an ordinary frequency distribution.

We observe that there are 80 students getting marks greater than or equal to 0 and 77 students have secured 10 and more marks.

Therefore, the number of students getting marks between 0 and 10 is $80 - 77 = 3$.

Similarly, the number of students getting marks between 10 and 20 is $77 - 72 = 5$ and so on.

Marks	Mid-value (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 55}{10}$	$f_i u_i$
0-10	5	3	-5	-15
10-20	15	5	-4	-20
20-30	25	7	-3	-21
30-40	35	10	-2	-20
40-50	45	12	-1	-12
50-60	55	15	0	0
60-70	65	12	1	12
70-80	75	6	2	12
80-90	85	2	3	6
90-100	95	8	4	32
Total		$\Sigma f_i = 80$		$\Sigma f_i u_i = -26$

Let assumed mean (a) = 55.

We have,

$$N = \Sigma f_i = 80, \Sigma f_i u_i = -26, a = 55 \text{ and } h = 10$$

$$\begin{aligned} \therefore \bar{X} &= a + h \frac{\Sigma f_i u_i}{N} \\ \Rightarrow \bar{X} &= 55 + 10 \times \frac{-26}{80} \\ &= 55 - 3.25 = 51.75 \end{aligned}$$

Therefore, the mean number of marks is 51.75

20. i. **Less than series:**

Marks	Number of students
Less than 5	2
Less than 10	7
Less than 15	13
Less than 20	21
Less than 25	31
Less than 30	56
Less than 35	76
Less than 40	94
Less than 45	98
Less than 50	100

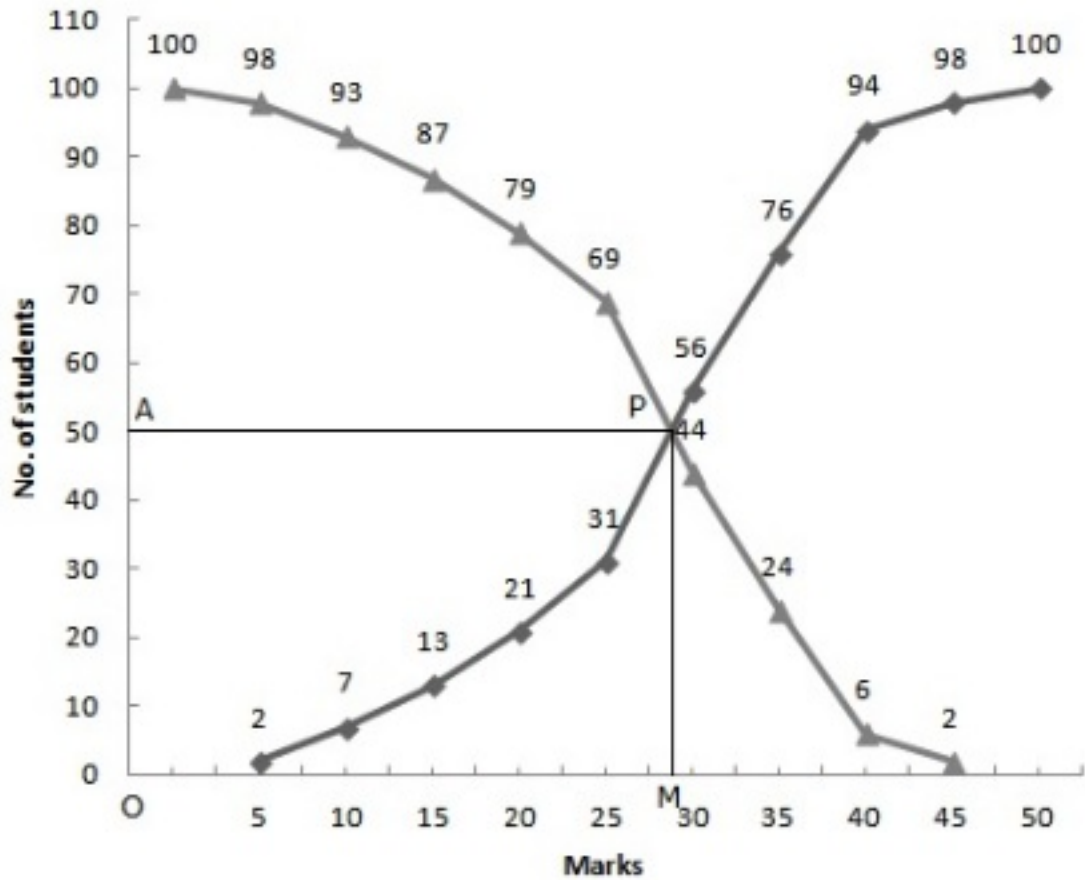
Plot the points (5, 2), (10, 7), (15, 13), (20, 21), (25, 31), (30, 56), (35, 76), (40, 94), (45, 98) and (50, 100).

Join these points free hand to get the "less than" cumulative curve.

ii. 'more than' series:

Marks	Number of students
More than 45	2
More than 40	6
More than 35	24
More than 30	44
More than 25	69
More than 20	79
More than 15	87
More than 10	93
More than 5	98
More than 0	100

Now, on the same graph paper as above, we plot the point (0, 100), (5, 98), (10, 93), (15, 87), (20, 79), (25, 69), (30, 44), (35, 24), (40, 6) and (45, 2)



$$N = 100 \Rightarrow \frac{N}{2} = 50$$

Two curves intersect at Point P(28, 50)

Hence, median = 28